RESPONSES OF THE JOVIAN ATMOSPHERE TO COMETARY PARTICLES AND PHOTON IMPACTS

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Detailed calculations were performed of the deposition of energetic oxygen ions into the atmosphere of Jupiter. A Monte Carlo simulation was used. Horanyi et al. (1988) had suggested that cascading transitions falling electron capture by highly charged ions give rise to the X-rays detected in auroras on Jupiter. We computed the expected spectrum and found it to be broadly consistent with the measurements. A paper has been published (Kharchenko, Liu and Dalgarno 1998). We had intended to include the contributions from sulfur ions but the required data base of cross sections is extensive and not yet available.

Similar processes occur in other astrophysical environments (see for example Tabischeff, Ramaty and Kovelovsky 1998) to which our methods can be applied. In particular Cravens (1997) has suggested that the X-ray emissions seen from comets are due to transitions from excited states following capture of electrons by solar wind ions colliding with the atmosphere of the comet. Alternative proposals have been advanced for the source of the cometary X-rays. We have carried out a study of the spectra and have shown that with the spectral resolution of about 20 eV the different excitation mechanisms can be distinguished (Kharchenko and Dalgarno 2000).

Our further studies of the response of the two components of the solar wind have predicted a spectrum that is consistent with the cometary observations (Lisse et al. 2001) and have further established that the X-rays from the comet's arise from the slow solar wind (Kharchenko and Dalgarno 2001).